

SEQUENCE LISTING

<110> HEGEMANN, Peter
 <120> USE OF BIOLOGICAL PHOTORECEPTORS AS DIRECTLY LIGHT-CONTROLLED ION CHANNELS
 <130> 231181
 <160> 4
 <170> PatentIn version 3.1
 <210> 1
 <211> 712
 <212> PRT
 <213> Chlamydomonas reinhardtii

<220>

<223> Amino acid sequence of CHOP-1 from
 Chlamydomonas reinhardtii

<400> 1

```

Met Ser Arg Arg Pro Trp Leu Leu Ala Leu Ala Leu Ala Val Ala Leu
 1          5          10
Ala Ala Gly Ser Ala Gly Ala Ser Thr Gly Ser Asp Ala Thr Val Pro
          20          25          30
Val Ala Thr Gln Asp Gly Pro Asp Tyr Val Phe His Arg Ala His Glu
          35          40          45
Arg Met Leu Phe Gln Thr Ser Tyr Thr Leu Glu Asn Asn Gly Ser Val
          50          55          60
Ile Cys Ile Pro Asn Asn Gly Gln Cys Phe Cys Leu Ala Trp Leu Lys
          65          70          75
Ser Asn Gly Thr Asn Ala Glu Lys Leu Ala Ala Asn Ile Leu Gln Trp
          85          90          95
Ile Thr Phe Ala Leu Ser Ala Leu Cys Leu Met Phe Tyr Gly Tyr Gln
          100          105
Thr Trp Lys Ser Thr Cys Gly Trp Glu Glu Ile Tyr Val Ala Thr Ile
          115          120          125
Glu Met Ile Lys Phe Ile Ile Glu Tyr Phe His Glu Phe Asp Glu Pro

```

231181.ST25.txt
140

130 135 140
Ala Val Ile Tyr Ser Ser Asn Gly Asn Lys Thr Val Trp Leu Arg Tyr
145 150 155 160
Ala Glu Trp Leu Leu Thr Cys Pro Val Ile Leu Ile His Leu Ser Asn
165 170 175
Leu Thr Gly Leu Ala Asn Asp Tyr Asn Lys Arg Thr Met Gly Leu Leu
180 185 190
Val Ser Asp Ile Gly Thr Ile Val Trp Gly Thr Thr Ala Ala Leu Ser
195 200 205
Lys Gly Tyr Val Arg Val Ile Phe Phe Leu Met Gly Leu Cys Tyr Gly
210 215 220
Ile Tyr Thr Phe Phe Asn Ala Ala Lys Val Tyr Ile Glu Ala Tyr His
225 230 235 240
Thr Val Pro Lys Gly Ile Cys Arg Asp Leu Val Arg Tyr Leu Ala Trp
245 250 255
Leu Tyr Phe Cys Ser Trp Ala Met Phe Pro Val Leu Phe Leu Leu Gly
260 265 270
Pro Glu Gly Phe Gly His Ile Asn Gln Phe Asn Ser Ala Ile Ala His
275 280 285
Ala Ile Leu Asp Leu Ala Ser Lys Asn Ala Trp Ser Met Met Gly His
290 295 300
Phe Leu Arg Val Lys Ile His Glu His Ile Leu Leu Tyr Gly Asp Ile
305 310 315 320
Arg Lys Lys Gln Lys Val Asn Val Ala Gly Gln Glu Met Glu Val Glu
325 330 335
Thr Met Val His Glu Glu Asp Asp Glu Thr Gln Lys Val Pro Thr Ala
340 345 350
Lys Tyr Ala Asn Arg Asp Ser Phe Ile Ile Met Arg Asp Arg Leu Lys
355 360 365
Glu Lys Gly Phe Glu Thr Arg Ala Ser Leu Asp Gly Asp Pro Asn Gly
370 375 380
Asp Ala Glu Ala Asn Ala Ala Ala Gly Gly Lys Pro Gly Met Glu Met
385 390 395 400
Gly Lys Met Thr Gly Met Gly Met Gly Ala Gly Met Gly Met
405 410 415
Ala Thr Ile Asp Ser Gly Arg Val Ile Leu Ala Val Pro Asp Ile Ser
420 425 430
Met Val Asp Phe Phe Arg Glu Gln Phe Ala Arg Leu Pro Val Pro Tyr
435 440 445
Glu Leu Val Pro Ala Leu Gly Ala Glu Asn Thr Leu Gln Leu Val Gln
450 455 460
Gln Ala Gln Ser Leu Gly Gly Cys Asp Phe Val Leu Met His Pro Glu
465 470 475 480 485 490 495

465 470 475 480
 Phe Leu Arg Asp Arg Ser Pro Thr Gly Leu Leu Pro Arg Leu Lys Met
 485 490 495
 Gly Gly Gln Arg Ala Ala Ala Phe Gly Trp Ala Ala Ile Gly Pro Met
 500 505 510
 Arg Asp Leu Ile Glu Gly Ser Gly Val Asp Gly Trp Leu Glu Gly Pro
 515 520 525
 Ser Phe Gly Ala Gly Ile Asn Gln Gln Ala Leu Val Ala Leu Ile Asn
 530 535 540
 Arg Met Gln Gln Ala Lys Lys Met Gly Met Met Gly Gly Met Gly Met
 545 550 555 560
 Gly Met Gly Gly Gly Met Gly Met Gly Met Gly Met Gly Met
 565 570 575
 Ala Pro Ser Met Asn Ala Gly Met Thr Gly Gly Met Gly Gly Ala Ser
 580 585 590
 Met Gly Gly Ala Val Met Gly Met Gly Met Gly Met Gln Pro Met Gln
 595 600 605
 Gln Ala Met Pro Ala Met Ser Pro Met Met Thr Gln Gln Pro Ser Met
 610 615 620
 Met Ser Gln Pro Ser Ala Met Ser Ala Gly Gly Ala Met Gln Ala Met
 625 630 635 640
 Gly Gly Val Met Pro Ser Pro Ala Pro Gly Gly Arg Val Gly Thr Asn
 645 650 655
 Pro Leu Phe Gly Ser Ala Pro Ser Pro Leu Ser Ser Gln Pro Gly Ile
 660 665 670
 Ser Pro Gly Met Ala Thr Pro Pro Ala Ala Thr Ala Ala Pro Ala Ala
 675 680 685
 Gly Gly Ser Glu Ala Glu Met Leu Gln Gln Leu Met Ser Glu Ile Asn
 690 695 700
 Arg Leu Lys Asn Glu Leu Gly Glu
 705 710

<210> 2

<211> 737

<212> PRT

<213> Chlamydomonas reinhardtii

<220>

 <223> Amino acid sequence of CHOP-2 from
 Chlamydomonas reinhardtii

<400> 2

231181.ST25.txt

Met Asp Tyr Gly Gly Ala Leu Ser Ala Val Gly Arg Glu Leu Leu Phe
 1 5 10 15
 Val Thr Asn Pro Val Val Val Asn Gly Ser Val Leu Val Pro Glu Asp
 20 25 30
 Gln Cys Tyr Cys Ala Gly Trp Ile Glu Ser Arg Gly Thr Asn Gly Ala
 35 40 45
 Gln Thr Ala Ser Asn Val Leu Gln Trp Leu Ala Ala Gly Phe Ser Ile
 50 55 60
 Leu Leu Leu Met Phe Tyr Ala Tyr Gln Thr Trp Lys Ser Thr Cys Gly
 65 70 75 80
 Trp Glu Glu Ile Tyr Val Cys Ala Ile Glu Met Val Lys Val Ile Leu
 85 90 95
 Glu Phe Phe Phe Glu Phe Lys Asn Pro Ser Met Leu Tyr Leu Ala Thr
 100 105 110
 Gly His Arg Val Gln Trp Leu Arg Tyr Ala Glu Trp Leu Leu Thr Cys
 115 120 125
 Pro Val Ile Leu Ile His Leu Ser Asn Leu Thr Gly Leu Ser Asn Asp
 130 135 140
 Tyr Ser Arg Arg Thr Met Gly Leu Leu Val Ser Asp Ile Gly Thr Ile
 145 150 155 160
 Val Trp Gly Ala Thr Ser Ala Met Ala Thr Gly Tyr Val Lys Val Ile
 165 170 175
 Phe Phe Cys Leu Gly Leu Cys Tyr Gly Ala Asn Thr Phe Phe His Ala
 180 185 190
 Ala Lys Ala Tyr Ile Glu Gly Tyr His Thr Val Pro Lys Gly Arg Cys
 195 200 205
 Arg Gln Val Val Thr Gly Met Ala Trp Leu Phe Phe Val Ser Trp Gly
 210 215 220
 Met Phe Pro Ile Leu Phe Ile Leu Gly Pro Glu Gly Phe Gly Val Leu
 225 230 235 240
 Ser Val Tyr Gly Ser Thr Val Gly His Thr Ile Ile Asp Leu Met Ser
 245 250 255
 Lys Asn Cys Trp Gly Leu Leu Gly His Tyr Leu Arg Val Leu Ile His
 260 265 270
 Glu His Ile Leu Ile His Gly Asp Ile Arg Lys Thr Thr Lys Leu Asn
 275 280 285
 Ile Gly Gly Thr Glu Ile Glu Val Glu Thr Leu Val Glu Asp Glu Ala
 290 295 300
 Glu Ala Gly Ala Val Asn Lys Gly Thr Gly Lys Tyr Ala Ser Arg Glu
 305 310 315 320
 Ser Phe Leu Val Met Arg Asp Lys Met Lys Glu Lys Gly Ile Asp Val
 325 330 335

231181.ST25.txt

Arg Ala Ser Leu Asp Asn Ser Lys Glu Val Glu Gln Glu Gln Ala Ala
 340 345 350
 Arg Ala Ala Met Met Met Met Asn Gly Asn Gly Met Gly Met Gly Met
 355 360 365
 Gly Met Asn Gly Met Asn Gly Met Gly Gly Met Asn Gly Met Ala Gly
 370 375 380
 Gly Ala Lys Pro Gly Leu Glu Leu Thr Pro Gln Leu Gln Pro Gly Arg
 385 390 395 400
 Val Ile Leu Ala Val Pro Asp Ile Ser Met Val Asp Phe Phe Arg Glu
 405 410 415
 Gln Phe Ala Gln Leu Ser Val Thr Tyr Glu Leu Val Pro Ala Leu Gly
 420 425 430
 Ala Asp Asn Thr Leu Ala Leu Val Thr Gln Ala Gln Asn Leu Gly Gly
 435 440 445
 Val Asp Phe Val Leu Ile His Pro Glu Phe Leu Arg Asp Arg Ser Ser
 450 455 460
 Thr Ser Ile Leu Ser Arg Leu Arg Gly Ala Gly Gln Arg Val Ala Ala
 465 470 475 480
 Phe Gly Trp Ala Gln Leu Gly Pro Met Arg Asp Leu Ile Glu Ser Ala
 485 490 495
 Asn Leu Asp Gly Trp Leu Glu Gly Pro Ser Phe Gly Gln Gly Ile Leu
 500 505 510
 Pro Ala His Ile Val Ala Leu Val Ala Lys Met Gln Gln Met Arg Lys
 515 520 525
 Met Gln Gln Met Gln Gln Ile Gly Met Met Thr Gly Gly Met Asn Gly
 530 535 540
 Met Gly Gly Gly Met Gly Gly Gly Met Asn Gly Met Gly Gly Gly Asn
 545 550 555 560
 Gly Met Asn Asn Met Gly Asn Gly Met Gly Gly Gly Met Gly Asn Gly
 565 570 575
 Met Gly Gly Asn Gly Met Asn Gly Met Gly Gly Gly Asn Gly Met Asn
 580 585 590
 Asn Met Gly Gly Asn Gly Met Ala Gly Asn Gly Met Gly Gly Gly Met
 595 600 605
 Gly Gly Asn Gly Met Gly Gly Ser Met Asn Gly Met Ser Ser Gly Val
 610 615 620
 Val Ala Asn Val Thr Pro Ser Ala Ala Gly Gly Met Gly Gly Met Met
 625 630 635 640
 Asn Gly Gly Met Ala Ala Pro Gln Ser Pro Gly Met Asn Gly Gly Arg
 645 650 655
 Leu Gly Thr Asn Pro Leu Phe Asn Ala Ala Pro Ser Pro Leu Ser Ser
 660 665 670

231181.ST25.txt

Gln Leu Gly Ala Glu Ala Gly Met Gly Ser Met Gly Gly Met Gly Gly
 675 680 685
 Met Ser Gly Met Gly Gly Met Gly Gly Met Gly Gly Met Gly Gly Ala
 690 695 700
 Gly Ala Ala Thr Thr Gln Ala Ala Gly Gly Asn Ala Glu Ala Glu Met
 705 710 715 720
 Leu Gln Asn Leu Met Asn Glu Ile Asn Arg Leu Lys Arg Glu Leu Gly
 725 730 735

Glu

<210> 3

<211> 259

<212> PRT

<213> Halobacterium salinarum

<220>

<223> Amino acid sequence of bacteriorhodopsin from
 Halobacterium salinarum

<400> 3
 Met Leu Pro Thr Ala Val Glu Gly Val Ser Gln Ala Gln Ile Thr Gly
 1 5 10 15
 Arg Pro Glu Trp Ile Trp Leu Ala Leu Gly Thr Ala Leu Met Gly Leu
 20 25 30
 Gly Thr Leu Tyr Phe Leu Val Lys Gly Met Gly Val Ser Asp Pro Asp
 35 40 45
 Ala Lys Lys Phe Tyr Ala Ile Thr Thr Leu Val Pro Ala Ile Ala Phe
 50 55 60
 Thr Met Tyr Leu Ser Met Leu Leu Gly Tyr Gly Leu Thr Met Val Pro
 65 70 75 80
 Phe Gly Gly Glu Gln Asn Pro Ile Tyr Trp Ala Arg Tyr Ala Asp Trp
 85 90 95
 Leu Phe Thr Thr Pro Leu Leu Leu Leu Asp Leu Ala Leu Leu Val Asp
 100 105 110
 Ala Asp Gln Gly Thr Ile Leu Ala Leu Val Gly Ala Asp Gly Ile Met
 115 120 125
 Ile Gly Thr Gly Leu Val Gly Ala Leu Thr Lys Val Tyr Ser Tyr Arg
 130 135 140
 Phe Val Trp Trp Ala Ile Ser Thr Ala Ala Met Leu Tyr Ile Leu Tyr
 145 150 155 160
 Val Leu Phe Phe Gly Phe Thr Ser Lys Ala Glu Ser Met Arg Pro Glu
 Page 6

231181.ST25.txt

165
 Val Ala Ser Thr Phe Lys Val Leu Arg Asn Val Thr Val Val Leu Trp
 180 185 190
 Ser Ala Tyr Pro Val Val Trp Leu Ile Gly Ser Glu Gly Ala Gly Ile
 195 200 205
 Val Pro Leu Asn Ile Glu Thr Leu Leu Phe Met Val Leu Asp Val Ser
 210 215 220
 Ala Lys Val Gly Phe Gly Leu Ile Leu Leu Arg Ser Arg Ala Ile Phe
 225 230 235 240
 Gly Glu Ala Glu Ala Pro Glu Pro Ser Ala Gly Asp Gly Ala Ala Ala
 245 250 255
 Thr Ser Asp

<210> 4
 <211> 315
 <212> PRT
 <213> Chlamydomonas reinhardtii

<220>

<223> Amino acid sequence of the CHOP2-315/H134R mutant

<400> 4

Met Asp Tyr Gly Gly Ala Leu Ser Ala Val Gly Arg Glu Leu Leu Phe
 1 5 10 15

Val Thr Asn Pro Val Val Val Asn Gly Ser Val Leu Val Pro Glu Asp
 20 25 30

Gln Cys Tyr Cys Ala Gly Trp Ile Glu Ser Arg Gly Thr Asn Gly Ala
 35 40 45

Gln Thr Ala Ser Asn Val Leu Gln Trp Leu Ala Ala Gly Phe Ser Ile
 50 55 60

Leu Leu Leu Met Phe Tyr Ala Tyr Gln Thr Trp Lys Ser Thr Cys Gly
 65 70 75 80

Trp Glu Glu Ile Tyr Val Cys Ala Ile Glu Met Val Lys Val Ile Leu
 85 90 95

Glu Phe Phe Phe Glu Phe Lys Asn Pro Ser Met Leu Tyr Leu Ala Thr
 100 105 110

Gly His Arg Val Gln Trp Leu Arg Tyr Ala Glu Trp Leu Leu Thr Cys
 Page 7

115

120

125

Pro Val Ile Leu Ile Arg Leu Ser Asn Leu Thr Gly Leu Ser Asn Asp
 130 135 140
 Tyr Ser Arg Arg Thr Met Gly Leu Leu Val Ser Asp Ile Gly Thr Ile
 145 150 155 160
 Val Trp Gly Ala Thr Ser Ala Met Ala Thr Gly Tyr Val Lys Val Ile
 165 170
 Phe Phe Cys Leu Gly Leu Cys Tyr Gly Ala Asn Thr Phe Phe His Ala
 180 185 190
 Ala Lys Ala Tyr Ile Glu Gly Tyr His Thr Val Pro Lys Gly Arg Cys
 195 200 205
 Arg Gln Val Val Thr Gly Met Ala Trp Leu Phe Phe Val Ser Trp Gly
 210 215 220
 Met Phe Pro Ile Leu Phe Ile Leu Gly Pro Glu Gly Phe Gly Val Leu
 225 230 235 240
 Ser Val Tyr Gly Ser Thr Val Gly His Thr Ile Ile Asp Leu Met Ser
 245 250 255
 Lys Asn Cys Trp Gly Leu Leu Gly His Tyr Leu Arg Val Leu Ile His
 260 265 270
 Glu His Ile Leu Ile His Gly Asp Ile Arg Lys Thr Thr Lys Leu Asn
 275 280 285
 Ile Gly Gly Thr Glu Ile Glu Val Glu Thr Leu Val Glu Asp Glu Ala
 290 295 300
 Glu Ala Gly Ala Val Asn Lys Gly Thr Gly Lys
 305 310 315